भारतीय मानक
Indian Standard

IS 2553 (Part 3) : 2019

सुरक्षा उपयोगी काँच — विशिष्टि

भाग 3 सौर उपयोग हेतु

Safety Glass — Specification

Part 3 Solar Applications

ICS 81.040.20; 27.160

© BIS 2019

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

May 2019 **Price Group 3**

Glass, Glassware and Laboratoryware Sectional Committee, CHD 10

FOREWORD

This Indian Standard (Part 3) was adopted by the Bureau of Indian Standards, after the draft finalized by the Glass, Glassware and Laboratoryware Sectional Committee had been approved by the Chemical Division Council.

Solar energy is widely considered as a promising alternative to fossil fuels. It is used in a variety of applications like direct and indirect electricity generation, water heating etc. Solar energy has the advantages of being renewable and non-polluting. Low iron float or patterned glass, which is duly toughened, is used as a protective covering in photovoltaic modules and solar flat plate collectors. The intrinsic properties of such glass help in protecting the equipment as well as harnessing maximum possible radiation intensity and infra-red energy from solar radiation.

This standard was drafted by CHD 10 : 4 processed glass subcommittee. The list of experts who made significant contribution to the formulation of this standard is given at Annex B.

This Indian Standard is published in three parts. The other parts of this series are:

Part 1 Architectural, building and general uses
Part 2 For road transport

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SAFETY GLASS — SPECIFICATION

PART 3 SOLAR APPLICATIONS

1 SCOPE

This standard (Part 3) prescribes the requirements, method of sampling and tests for safety glass for use in solar applications. This includes both photovoltaic panels and solar flat plate collectors.

2 REFERENCES

The standards listed below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
1382 : 1981	Glossary of terms related to glass and glassware (*first revision*)
2303 (Part 1/ Sec 2) : 2012	Grading glass: Part 1 Method of test and classification, Section 2 Hydrolytic resistance of glass grains at 121°C (*second revision*)
2553 (Part 1) : 2018	Safety glass — Specification: Part 1 Architectural, building and general uses (*fourth revision*)
4905 : 2015	Random sampling and randomization procedures (*first revision*)
14286 : 2010	Crystalline silicon terrestrial photovoltaic (PV) modules — Design qualification and type approval (*first revision*)
14900 : 2018	Transparent float glass — Specification (*first revision*)
16231 (Part 2) : 2019	Use of glass in building — Code of practice: Part 2 Energy and light (*first revision*)
17004 : 2018	Testing methods for processed glass

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 1382, IS 2553 (Part 1), IS 14900 and IS 16231 (Part 2) shall apply.

Table 1 Requirements

(*Clause* 4.2 and 6)

Sl No.	**Characteristic**		**Requirement**	**Test Method**
(1)	(2)		(3)	(4)
i)	Dimensions[1]		Table 2	Suitable calibrated equipment
ii)	Squareness[1]		Table 3	Suitable calibrated equipment
iii)	Flatness	Overall bow, *Max*	4 mm/m	**5.2** of IS 17004
iv)		Local distortion[2], *Max*	1 mm/ 300 mm	**5.5** of IS 17004
v)		Roller wave[3], *Max*	0.5 mm	**5.3** of IS 17004
vi)	Fragmentation, *Min*		Table 4	**6.1** of IS 17004
vii)	Resistance to shock (Ball drop) test[4]		**6.2.1** of IS 17004	
viii)	Mechanical strength, *Min*		120 MPa	**6.3** of IS 17004
ix)	Hail test (optional)		Glass shall neither crack nor break	**10.17** of IS 14286

[1] In case of dispute, a calibrated vernier caliper is recommended for measurement.

[2] For vertically toughened glass only.

[3] For horizontally toughened glass only.

[4] For glasses of thickness less than 5 mm, ball drop test shall be carried out as prescribed in **6.2.1** of IS 17004, using a steel ball of mass 227 g.

4 REQUIREMENTS

4.1 Raw Material

For photovoltaic modules, the raw glass shall conform to the requirements specified in Doc CHD 10 (13078). For solar flat plate collector, the raw glass shall conform to either IS 14900 or Doc CHD 10 (13078).

NOTE — Doc CHD 10 (13078) 'Low iron textured glass — Specification' is under development.

4.2 The glass shall be thermally toughened and shall satisfy all the requirements prescribed in Table 1.

Table 2 Tolerances on Width, *W*, and Length, *L*

[*Table* 1(i)]

Nominal Dimension of Side, *W* or *L*	Tolerance on Dimensions
≤ 2 000	± 1.5
> 2 000 and ≤ 3 000	± 2.0

All dimensions are in mm.

Table 3 Limit Deviations for the Difference between Diagonals

[*Table* 1(ii)]

Nominal Dimension, W or L	Difference Between Diagonals
≤ 2 000	≤ 3
> 2 000 and ≤ 3 000	≤ 4

All dimensions are in mm.

Table 4 Minimum Particle Count for Fragmentation Test

[*Table* 1(iv)]

Nominal Thickness (mm)	Minimum Particle Count (Number)
< 4	15
4 to 12	40

5 PACKING AND MARKING

5.1 Packing

The solar glass sheets shall be packed as agreed to between the purchaser and supplier. However, the following aspects shall be adhered to:

a) There shall be interleaving protection in the form of strings, paper or powder.
b) Silica gel shall be provided for absorbing moisture.
c) 200 micron polythene to be used for wrapping the sheets.

5.2 Marking

5.2.1 Each package of glass shall be marked with the following information:

a) Indication of source of manufacture;
b) Nominal length, width and thickness, in mm; and
c) No. of panes per package.

5.2.2 Each piece of glass is recommended to be marked with the following details:

a) Indication of source of manufacture, and
b) Nominal thickness, in mm.

5.2.3 *BIS Certification Marking*

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the products may be marked with the standard mark.

6 SAMPLING

All the glasses of the same nominal thickness which are processed under similar conditions in a day shall be grouped together and constitute a lot. Sample shall be made and tested from each lot to determine its conformity to the requirements of this specification. In order to ensure the randomness of selection, procedure given in IS 4905 shall be followed.

The sampling plan as described in Table 5 may be followed for the various tests to be performed as per the requirements specified in Table 1.

Table 5 Sample Size and Criteria for Conformity

(*Clause* 6)

Sl No. (1)	Testing Parameters (2)	No. of Samples (3)	Size of Samples (4)	Acceptance Criteria (5)
i)	Thickness	5 percent of the quantity from each thickness, but not less than five glasses.	Actual size of product	All samples shall pass. In case of any single failure, draw another 5 percent and repeat the tests. No failure shall occur.
ii)	Dimensions			
iii)	Squareness			
iv)	Flatness			
v)	Fragmentation test	2	0.36 m^2 (360 mm × 1 100 mm recommended)	All samples shall pass. In case of any single failure, draw another 2 samples from the lot and repeat the test. No failure shall occur.
vi)	Resistance to shock (ball drop) test	2	610 mm × 610 mm	All samples shall pass. In case of any single failure, draw another 2 samples from the lot and repeat the test. No failure shall occur.
vii)	Mechanical strength	2	360 mm × 1 100 mm	All samples shall pass. In case of any single failure, draw another 2 samples from the lot and repeat the test. No failure shall occur.

ANNEX A

(*Informative*)

ANTIREFLECTIVE COATING

In an uncoated glass, reflection and absorption of incident light leads to a maximum achievable light transmission of approximately 91.5 percent.

Anti-reflective coating may be applied on the glass surface by rolling, spraying or dipping (for example, by dipping in a metal oxide solution). It can significantly reduce reflection of incident light, thereby improving contrast and can result in a light transmission greater than 93 percent in 380 to 1 100 nm wavelength range.

ANNEX B

(*Foreword*)

EXPERTS WHO MADE SIGNIFICANT CONTRIBUTION TO THE DEVELOPMENT OF THIS STANDARD

Organization	*Representative(s)*
CSIR-Central Glass & Ceramic Research Institute, Kolkata	Dr K. Muraleedharan (***Chairman***, CHD 10) Dr B. B. Jha (*Alternate*) Dr K. Annapurna (*Alternate*)
Allied Glasses Pvt. Ltd.	Shri G. K. Bansal
Asahi India Glass Limited	Shri Rupinder Shelly Shri Praveen Saini (*Alternate*)
Borosil Glass Works Ltd	Shri Shrikant Gangan Shri Satish Chitriv (*Alternate*)
Birkan Engineering Pvt. Ltd.	Shri Mukesh Gupta
Confederation Construction Products and Services (CCPS)	Ms Sarita Balodhi
Controllerate of Quality Assurance (Materials)	Shri Mahipal
Federation of Safety Glass	Shri Sharanjit Singh (***Convener***, CHD 10 : 4) Shri Vinod Tandon (*Alternate*)
FG Glass Industries (P) Ltd.	Shri Tariq Kachwala
Glazing Society of India	Shri G. N. Gohul Deepak Shri Mathivanan M. (*Alternate*) Shri Subin Calvin Geo (*Alternate*)
Gold Plus Glass Industry Ltd	Shri Vivek Dubey Shri Premdutt (*Alternate*)
GSC Glass Ltd	Shri L. K. Aneja
Gujarat Borosil ltd.	Shri P. K. Kheruka Shri V. Ramaswami (*Alternate*) Shri M. V. Ramana (*Alternate*)
Gurind India Pvt. Ltd.	Shri Gurmeet S. Singh
HNG Float Glass Ltd.	Shri Ashish Pradhan
Icon Solar	Shri Debkumar Banerjee
Kaenat Glass Industries	Shri Ali Kamil

Organization	*Representative(s)*
North India Module Manufacturer Association	Shri Manish Gupta Shri Arpit Aggarwal (*Alternate*)
Office of the Development Commissioner (MSME)	Shri Santosh Kumar
Saint-Gobain India Pvt. Ltd.	Shri R. Subramanian Shri Murali N (*Alternate*)
Solutia Chemicals India Pvt Ltd	Shri V. B. Sud
The All India Glass Manufacturers Federation	Shri Sandeep Singh Shri Gopal Ganatra (*Alternate*)
Vikram Solar ltd.	Shri Amitava Majumdar
Voluntary Organization in Interest of Consumer Education (VOICE)	Shri B. K. Mukhopadhyay (*Alternate*)
Directorate General, BIS	Shri U. K. Das, Scientist 'E' and Head (CHD) [Representing Director General (*Ex-officio*)]

Member Secretary

Shri Sachin S. Menon
Scientist 'B' (CHD), BIS

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc No.: CHD 10 (12858).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices: *Telephones*

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002
{ 2323 7617
{ 2323 3841

Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi
KOLKATA 700054
{ 2337 8499, 2337 8561
{ 2337 8626, 2337 9120

Northern : Plot No. 4-A, Sector 27-B, Madhya Marg
CHANDIGARH 160019
{ 265 0206
{ 265 0290

Southern : C.I.T. Campus, IV Cross Road, CHENNAI 600113
{ 2254 1216, 2254 1442
{ 2254 2519, 2254 2315

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
MUMBAI 400093
{ 2832 9295, 2832 7858
{ 2832 7891, 2832 7892

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. COIMBATORE. DEHRADUN. DURGAPUR. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. JAMMU. JAMSHEDPUR. KOCHI. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE. RAIPUR. RAJKOT. VISAKHAPATNAM.

Published by BIS, New Delhi